CONSTRUCTION OF TAILING DUMPS DAMS BY USING MODERN MATERIALS

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ABSTRACT. During the construction of tailing dumps dams, modern materials can be used, which materials will improve the stability of dams and ensure high level of environmental protection. At tailing dumps where dams are built upstream or central it is possible the peripheral parts to be constructed by using geotubes. Thus improves the stability of the dam, prevents erosion and protects the air and surrounding area from fugitive emission of flotation sand with air currents. Also, to protect the slope from erosion and dispersion of flotation sand by air currents in dams, geosynthetic material Incomat can be used which is easy for setting up and filling and can be placed after each finished plate or parallel with the progress of the lamell during the construction of the dam. When tailing dumps dams are built in sludgy environment, highly strength geotextiles can be used, in order to improve the stability of the dam. Geotextiles can find application for covering the dry parts of the slopes and tops of the dams, and leave uncovered only parts for disposal of flotation sand. For retention of geotextiles anchors are used, if it is necessary they are moved depending on whether geotextile shrinks or stretches. With coverage of dams with geotextile, air from emission of flotation sand is protected.

Keywords: environment, stability, geotube, incomat, geotextile

INTRODUCTION

Accidents that have occurred in dams at flotation tailing dumps are an alarm for the application of modern methods and techniques for the design of dams at tailing dumps. Using modern materials for construction of dams nowadays is quite a actual topic, because it thus resolve many important issues for the protection of the environment. Geosynthetic materials that can find great use in the construction of dams at tailing dumps are: Geotube, Incomat, geotextile and so on.

CONSTRUCTION OF DAMS WITH GEOTUBES

Geotubes are fabrics of synthetic fibers which perform the function of protecting embankments from erosion, filtering material with different particle size and so on. The purpose of these geotubes is to retain suspended particles of tailing material from the processing of ore and to drain water (Figure 1).

Fig. 1 Typical Geotube in function

The utilization of geosynthetic polypropylene material that is fabricated in a cylindrical tube called geotube have received widespread attention over the past few years. Several companies have developed experience, engineering, software for the size of geotubes testing for chemical use and areas/fields for their installations.

Geotubes may have application at flotation tailing dumps so that when building sand dams, on peripheral parts geotubes would be placed (Figure 2), filled with flotation sand. Also geotubes can be used as barriers at auxiliary precipitation lakes in the regular case of operation of tailing dumps or in case of unwanted accidents.

During the filling of geotubes the content of water in the tailings should be increased up to 80%, i.e. an additional amount of water at the moment of filling of geotubes is necessary and filling is done by pressure pumps. With this method of engineering protection against erosion of the slope is achieved, the stability of the dam is increased and environmental protection is done by spreading the dry flotation sand with air stream. This method is possible for dams which are built upstream or central when dam begins with the construction of a wider area and during the construction the dam narrows (Figure 3) on the top, and geotubes can be placed at both ends of the dam. On that way, you will have significantly more stable dam or more stable tailing dump, protection will be provided for the surrounding terrain and protection from air dispersion of flotation sand during the air currents will be achieved.

Fig. 2 Building a dam with Geotube

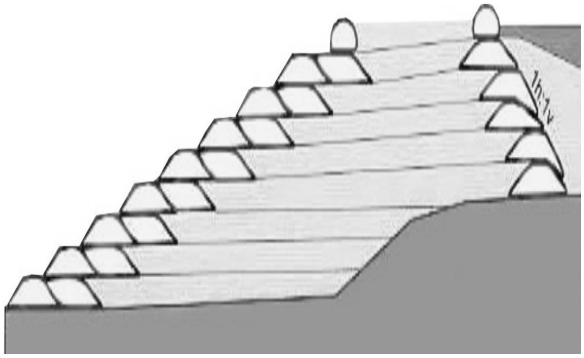

Fig. 3 Building a dam with Geotube

As a base for placement of geotubes would be impermeable geosynthetic materail such as - geomembrane that on the lowest parts would have drainage pipes for water drainage performance. Charging system for geotubes consists of pumps, pipelines, hoses, valves, etc.

Geotubes have a significant role in the prevention of accidents at dams of tailing dumps, in terms of increased presence of water. Figure 4 shows the phase before major accident (water flow of flotation particles of which the dam is built) and Figure 5 shows the

phase of the dam accident, ie when the increased presence of water causes separation of flotation particles and accident of dam.

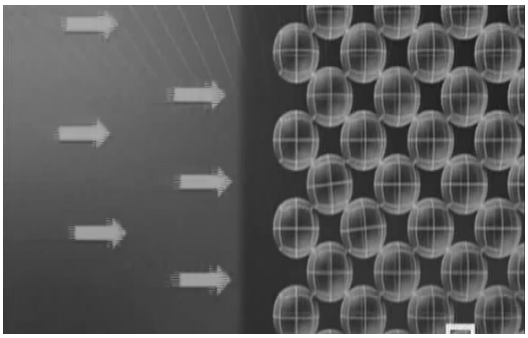

Fig. 4 Phase before accident

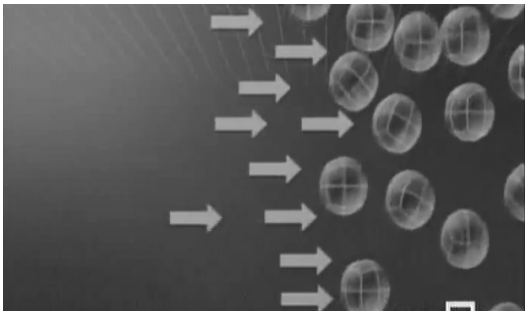

Fig. 5 Accident of dam

If geosynthetic materials as geotubes are used there is no possibility of accident occurrence (Figure 6), i.e. it is not possible separation of flotation solid particles to be done, thus preventing the destruction of the dam.

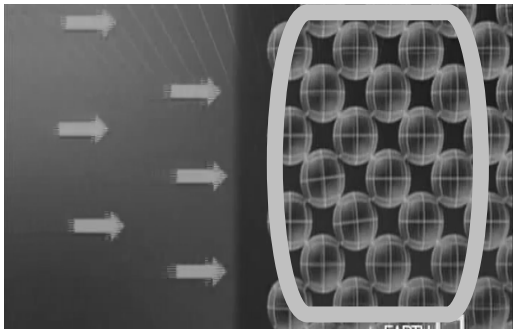

Fig. 6 Accident prevention with Geotube

CONSTRUCTION OF DAMS WITH INCOMAT

Incomat is high strength two-layered fabric which is use to stabilize embankments and foundations in hydro engineering works. It consists of two related high strength polyamide or polyethylene woven layers to form a flexible structure that can be filled with concrete, mortar, sand or any similar material. It is manufactured in two variants in the form of mattresses for a variety of applications: vent flexible mattresses and impermeable mattresses. It is manufactured in different shapes and sizes (Figure 7).

Different Incomat types offer diverse applications and possibilities. Incomat is installed just above or below the surface of the water without any difficulty, economically, reliable and technically simple for protection against erosion. Has a high UV resistance, good resistance to alkalis, acids, organic solvents and biologically active materials and is extremely durable. It is produced with a thickness of 6 to 60 cm.

Flexible Incomat can have application at flotation tailing dumps, so it would be installed on the slopes of tailing dump as the dam progresses and it would be filled with flotation sand (Figure 8). During the filling of Incomat it is necessary the content of water in the tailing to be increased up to 80%, i.e. an additional amount of water at the moment of filling of Incomat has to be add so the filling to be more evenly. The filling is done with pressure pumps.

This method provides protection against erosion of the slope and protects the environment by dispersion of dry flotation sand with air streams.

Fig. 7 Types of Incomat

Fig. 8 Installation of Incomat

This method is possible at flotation tailing dumps at which sand dam is built upstream or at oblique sections of flotation tailing dump that is constructed. For covering the slopes at flotation tailing dumps Incomat with small thickness is sufficient, that will prevent dispersion of flotation sand in the form of fugitive dust.

CONSTRUCTION OF DAMS WITH GEOTEXTILE

Geotextiles formed from synthetic fiber, with standard weaving machines are manufactured in flexible porous fabrics. During the

preparation synthetic fibers are merged and strengthen by application one of the following three procedures: wet, dry and dilation. Most geotextile fibers are formed by thawing at which they are susceptible to stretching, and by stretching their diameter reduces, the strength of tension increases and dilatation during breakage is reduced. By wrapping of long synthetic fibers multi fibrous bundle is formed. For connecting of synthetic fiber during the formation of non-woven geotextiles, there are three ways: thermal connection resin connecting and pins connection.

Geotextiles perform the functions of separation, reinforcement, filtration, drainage and as a barrier in landfills. There are different types of geotextiles (Figure 9), and are made according to the application in different engineering areas.

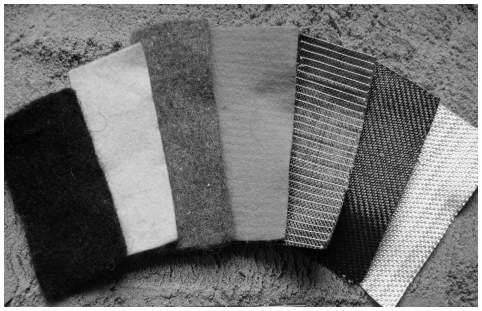

Fig. 9 Types of geotextile

Basic functions of geotextiles are:

- Separation between layers with different particle composition;
- Reinforcement, i.e. acceptance of shear stresses, due to the strength of tightening of geotextiles;
- Filtration, expressed through setting granular earth filter layers;
- Drainage, as a substitute for sand drainage, wrapping in drainage pipes etc.;
- Barrier for retention of liquids and gases in landfills combined with geomembranes, with the primary function of geotextile to protect geomembrane from mechanical damage.

During construction of dams at flotation tailing dumps geotextiles may have different functions. They can be used for separation (Figure 10), when starting with the construction of dams (Figure 11) in sludge environment, can be used for reinforcement of parts of dams, which thus improves the stability of dams.

Fig. 10 Lined geotextile for separation

At flotation tailing dumps where dams are built downstream is possible to perform cover of the dry parts of the slope and the top of dams with geosynthetic material geotextile (Figure 12), or as materials are packed in rolls they are spread or collected depending on their application and purpose, and leave uncovered only parts where the flotation sand is disposed.

For retention of geotextile anchoring is performed, anchors if needed are moved depending on whether geotextile is collected or spread. So on this way to protect the air the technique of spraying of dry parts with high-pressure water pump will be leaved and energy will be saved.

Fig. 11 Building of dam

Fig. 12 Geotextile

CONCLUSION

For greater stability of the dams at flotation tailing dumps and high level of protection of the environment, during the construction of dams modern materials should be used, such as geosynthetic materials.

Application of geotubes, Incomat, geotextiles, etc. materials during construction of dams, provides protection from appearance of erosion, improves the stability of the dam, enables protection of air and surrounding area from dispersion of flotation sand with air currents.

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